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Field Sampling Plan for the Pre-Remediation Sampling of the Central Facilities Area-04 Pond

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ABSTRACT

This field sampling plan outlines the collection and analysis of samples in support of the Central Facilities Area-04 mercury pond pre-remediation sampling. The selected remedy for the pond is defined in the *Final Comprehensive Record of Decision for Central Facilities Area Operable Unit 4-13* as excavation, treatment by stabilization, and disposal of the mercury-contaminated soils at the Idaho National Engineering and Environmental Laboratory.

There are three purposes for this sampling effort. First, although significant data exist defining the expected mercury concentrations in the contaminated soils, additional data are required to further refine the vertical extent of contamination to provide better direction for the remediation excavation effort. Second, additional data are neeed to determine the final treatment and/or disposal options for contaminated soils excavated from the pond. Third, sampling will determine whether the assumptions used in calculating the preliminary remediation goals are valid.

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ACRONYMS

ARAR	applicable or relevant and appropriate requirement
CEL	Chemical Engineering Laboratory
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
CFR	Code of Federal Regulations
COC	chain-of-custody
CSA	CERCLA storage area
CWSU	CERCLA waste storage unit
DOE-ID	Department of Energy Idaho Operations Office
DQO	data quality objective
DR	decision rule
DS	decision statement
EPA	Environmental Protection Agency
ER	environmental restoration
FFA/CO	Federal Facility Agreement and Consent Order
FSP	field sampling plan
FTL	field team leader
GDE	guide
GFPC	gas flow proportional counting
HASP	health and safety plan
HDPE	high-density polyethylene
ICDF	INEEL CERCLA Disposal Facility
ID	identification
INEEL	Idaho National Engineering and Environmental Laboratory

MCP	management control procedure
OU	operable unit
PQL	practical quantitation limit
PSQ	principal study question
QA	quality assurance
QA/QC	quality assurance/quality control
QAPjP	quality assurance project plan
QC	quality control
RadCon	radiological control
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
RMA	radioactive materials area
ROD	Record of Decision
RRWAC	reusable property, recyclable materials, and waste acceptance criteria
SAP	sampling and analysis plan
TCLP	toxicity characteristic leaching procedure
TPR	technical procedure
TSCA	Toxic Substances Control Act
WAG	waste area group
WGS	Waste Generator Services
WROC	Waste Reduction Operations Complex

Field Sampling Plan for the Pre-Remediation Sampling of the Central Facilities Area-04 Pond

1. OVERVIEW

This field sampling plan (FSP) is part of the sampling and analysis plan for the Central Facilities Area pond (CFA-04). The sampling and analysis plan for the Idaho National Engineering and Environmental Laboratory (INEEL) Waste Area Group (WAG) 4 pre-remediation sampling of the CFA-04 pond is comprised of two parts:

1. The FSP describing the sampling activities

2. The quality assurance project plan (QAPjP).

These plans have been prepared pursuant to the *National Oil and Hazardous Substances Contingency Plan* (Environmental Protection Agency [EPA] 1990), guidance from the EPA on the preparation of sampling and analysis plans (SAPs), and in accordance with Management Control Procedure (MCP)-241, "Preparation of Characterization Plans." The FSP describes the field sampling activities that will be performed, while the QAPjP details the processes and programs that will be used to ensure that the data generated are suitable for their intended uses. The FSP develops the data quality objectives (DQOs) upon which the collection of samples will be based. The governing QAPjP for this sampling effort will be the *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10 and Inactive Sites* (Department of Energy Idaho Operations Office [DOE-ID] 2000a). This document is incorporated herein by reference. Work control processes will follow formal practices as per communicated agreement between the appropriate site area director and the Environmental Restoration (ER) WAG 4 project manager and/or their designee(s).

1.1 Field Sampling Plan and Other Documentation

The purpose of this FSP is to guide the collection and analysis of samples required to further define the areal and vertical extent of the contamination at CFA-04 in accordance with the *Final Comprehensive Record of Decision for Central Facilities Area Operable Unit 4-13* (DOE-ID 2000b), hereinafter referred to as the Record of Decision (ROD). Sampling will be conducted to further refine the contaminant boundaries to enable the project to direct the remediation efforts while minimizing the generation of waste soils requiring disposal.

In addition, a health and safety plan (HASP) has been prepared for this project. The HASP, *Health and Safety Plan for the CFA-04 Mercury Pond Sampling and Remedial Action* (INEEL 2002), covers the activities associated with the remediation of the site, including the pre-remediation sampling. The *Interface Agreement Between the Environmental Restoration Program, Waste Area Groups 4, 5, 10, and D&D&D and the Central Facilities Area* (INEEL 1999) addresses activities related to the WAG 4 ROD (DOE-ID 2000b) and remedial design/remedial action as carried out within CFA under the purview of the CFA site area director.

1.2 Project Organization and Responsibility

The organizational structure for this work reflects the resources and expertise required to plan and perform the work, while minimizing risks to worker health and safety. The HASP (INEEL 2002) provides the job titles of the individuals who will be filling the key managerial roles and lines of responsibility and communication.

2. SITE BACKGROUND

2.1 Site Description

Located 51 km (32 mi) west of Idaho Falls, Idaho, the INEEL is a government-owned/contractor-operated facility managed by the DOE-ID (Figure 2-1). Occupying 2,305 km^2 (890 mi^2) of the northeastern portion of the Eastern Snake River Plain, the INEEL encompasses portions of five Idaho counties: (1) Butte, (2) Jefferson, (3) Bonneville, (4) Clark, and (5) Bingham.

The CFA has been used since 1949 to house many of the support services for all of the operations at the INEEL, including laboratories, security, fire protection, medical facilities, communication systems, warehouses, a cafeteria, vehicle and equipment pools, the bus system, and laundry facilities. The *Federal Facility Agreement and Consent Order* (FFA/CO) (DOE-ID 1991) identified 52 potential release sites at CFA, which were designated as WAG 4. The types of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites at WAG 4 include landfills, underground storage tanks, aboveground storage tanks, dry wells, disposal ponds, soil contamination sites, and a sewage plant. Each of these sites was placed into one of 13 operable units within the WAG, based on similarity of contaminants, environmental release pathways, and/or investigations.

The CFA-04 pond is a shallow, unlined surface depression that was originally a borrow pit for construction activities at the CFA (Figure 2-2). It is approximately 46 × 152 m (150 × 500 ft) and roughly 2 to 2.4 m (7 to 8 ft) deep. Basalt outcrops are present within and immediately adjacent to the pond. It received laboratory wastes from the Chemical Engineering Laboratory (CEL) in Building CFA-674 between 1953 and 1969. The CEL was used to conduct calcine experiments on simulated nuclear wastes. The calcining process was later used on actual nuclear wastes at the INEEL to change them from a liquid to a solid and to effect an overall volume reduction. The CEL experiments used mercury to dissolve simulated aluminum fuel cladding as well as radioisotope tracers in the calcining process. The primary waste streams discharged to the pond from the CEL included approximately 76.5 m^3 (100 yd^3) of mercury-contaminated calcine that contained low-level radioactive wastes and liquid effluent from the laboratory experiments. In addition, there is approximately 382 m^3 (500 yd^3) of rubble consisting of laboratory bottles, asphalt and asbestos roofing materials, reinforced concrete, and construction and demolition debris. The pond received run-off from the CFA site periodically between 1953 and 1995.

2.2 Nature and Extent of Contamination

The CFA-04 pond was identified as a Track 2 investigation site in the FFA/CO (DOE-ID 1991). Visual inspections in 1994 revealed the presence of calcine on the bermed areas around the periphery of the pond. Following surface and subsurface soil data collection from the calcine and the pond berm in early and mid-1994, a time-critical removal action in September 1994 excavated approximately 218 m^3 (285 yd^3) of calcine and calcine-contaminated soil and a small amount of asbestos from the bermed area. The soil was remediated at a portable retort set up northeast of the pond. Verification soil sampling conducted after the removal action showed that with the exception of one location having a mercury concentration of 233 mg/kg, the bermed areas had residual mercury concentrations less than the final remediation goal of 8.4 mg/kg (DOE-ID 2000c).

The ROD (DOE-ID 2000b) originally established a final remediation goal of 0.5 mg/kg for mercury contamination at CFA-04. This was an ecological goal based on ten times the average background concentration for composite samples. It was determined that a re-evaluation of the final remediation goal for mercury was warranted for both human and ecological receptors after new information recently became available from EPA sources. Based on this new information, hazard quotients were recalculated for the existing concentration of mercury at the CFA-04 pond. For the future residential exposure scenario, the recalculated hazard quotient is 7.56 as compared to 80 from the ROD

(DOE-ID 2000b). For the ecological risk assessment, the recalculated values are < 1 to 210 as compared to < 1 to 30,000 from the ROD (DOE-ID 2000b). Based upon this new information, the recalculated remediation goals for ecological and human health are 8.4 mg/kg and 9.4 mg/kg, respectively. The recalculated remediation goals for both human health and ecological receptors are consistent with the remedial action objectives for the CFA-04 pond. This information will be presented in more detail in an Explanation of Significant Differences that is currently being prepared.

During the 1995 Track 2 investigation, additional soil samples were collected from the pond inlet area, as well as a deeper area of the pond near the inlet where laboratory effluent may have collected. The results of the 1994 and 1995 soil investigations revealed that concentrations of the following constituents exceeded background concentrations for the INEEL: aluminum, arsenic, barium, cadmium, calcium, chromium, cobalt, lead, magnesium, mercury, nickel, Cs-137, Pa-234m, Sr-90, Th-234, U-234, U-235, and U-238. Aroclor-1254 was also detected at low levels. Preliminary risk screening indicated that the following constituents detected at the pond posed potential human health risks: aroclor-1254, arsenic, mercury, Cs-137, U-234, U-235, and U-238. The range of detected concentrations of these analytes is presented in Table 2-1. Based upon these data, the site was recommended for further characterization in the Operable Unit (OU) 4-13 Remedial Investigation/Feasibility Study (RI/FS) (INEEL 1996a).

Table 2-1. Range of detected concentrations.

Analyte	Range of Detected Concentrations
Arsenic	3.1 to 22.4 mg/kg
Mercury	0.12 to 439 mg/kg
Cs-137	0.0742 to 2 pCi/g
U-234	0.651 to 22.6 pCi/g
U-235	0.0225 to 1.6 pCi/g
U-238	0.73 to 35 pCi/g

Additional soil samples were collected for the OU 4-13 RI/FS during 1997 and 1998 at four areas along the length of the pipe connecting the CEL to the pond, in the area northeast of the pond known as the windblown area, and from the pond bottom. Data from these investigations confirmed the presence of mercury in these areas at concentrations up to 439 mg/kg (DOE-ID 1992). Four of the 88 samples exceeded the mercury Resource Conservation and Recovery Act (RCRA) characteristic hazardous waste level of 0.2 mg/L. Three of the four samples were in close proximity to one another in the pond and the fourth was an isolated occurrence in the windblown area and was eliminated. A contour line was drawn around the three closely spaced samples and the area was estimated. The depth of the soil in the pond was conservatively estimated to be 2.4 m (8 ft) in the pond bottom and 0.15 m (0.5 ft) in the windblown area, indicating that approximately 612 m^3 (800 yd^3) of soil is potentially characteristic waste per RCRA and is subject to land disposal restrictions upon excavation.

The only contaminant that poses an unacceptable risk to human health and the environment is mercury. Mercury-contaminated soil is present in the pond bottom, around the pond periphery in the berms, along the pipe connecting the CEL to the pond, and in the area northeast of the pond as a result of windblown contamination, an area encompassing approximately 91 × 183 m (300 × 600 ft). The OU 4-13 RI/FS conservatively estimated the volume of mercury-contaminated soil to be approximately 6,338 m^3 (8,290 yd^3), based on the dimensions of the pond bottoms, windblown area, and pipeline at depths of 2.4 m (8 ft), 0.15 m (0.5 ft), and 1.8 m (6 ft), respectively. This volume was calculated using the extent of contamination based upon the original final remediation goal of 0.50 mg/kg for total mercury as stated in the ROD (DOE-ID 2000b). The final volume may differ based upon the revised final remediation goal of 8.4 mg/kg and actual conditions encountered in the field.

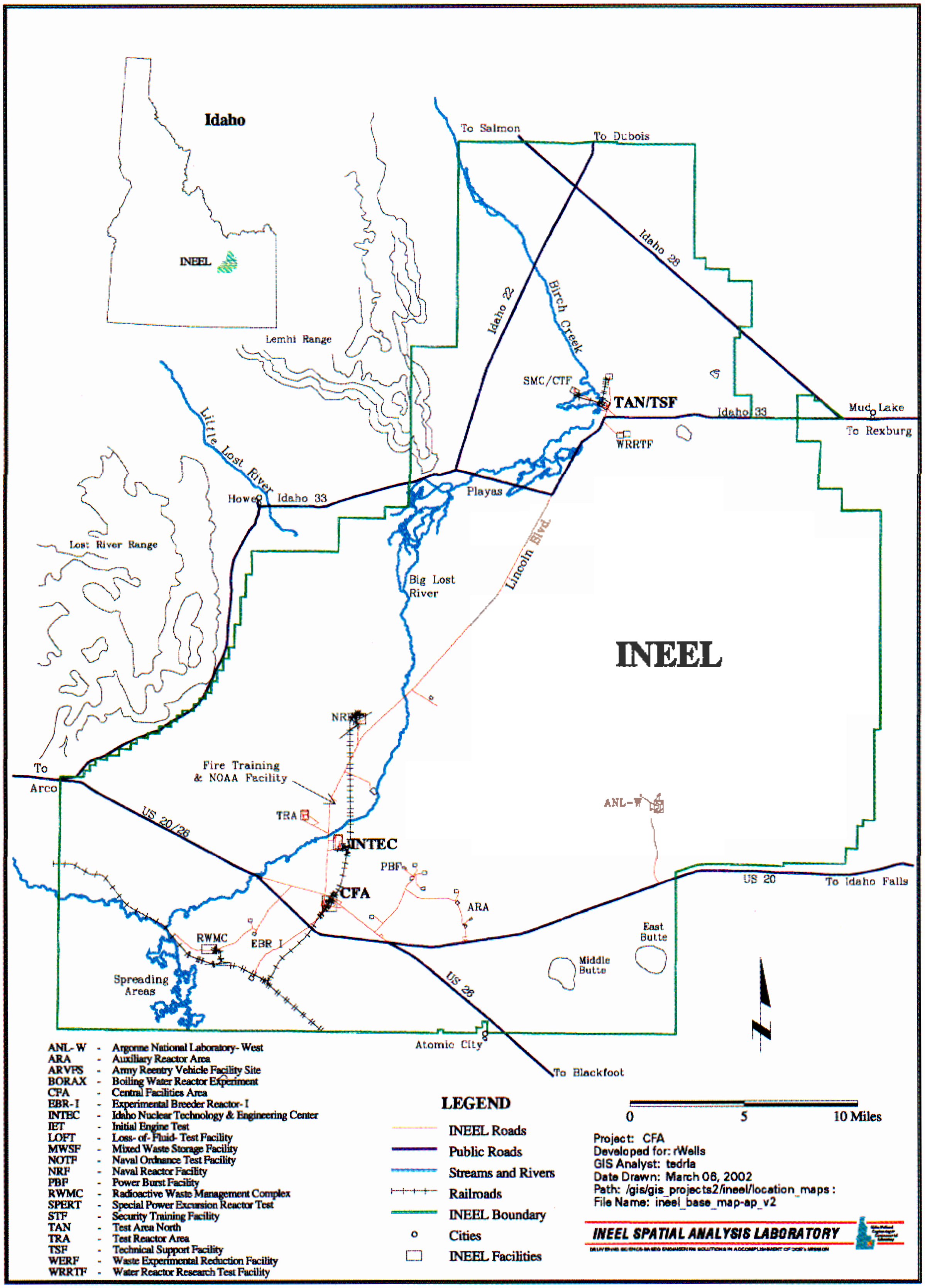

Figure 2-1. Idaho National Engineering and Environmental Laboratory.

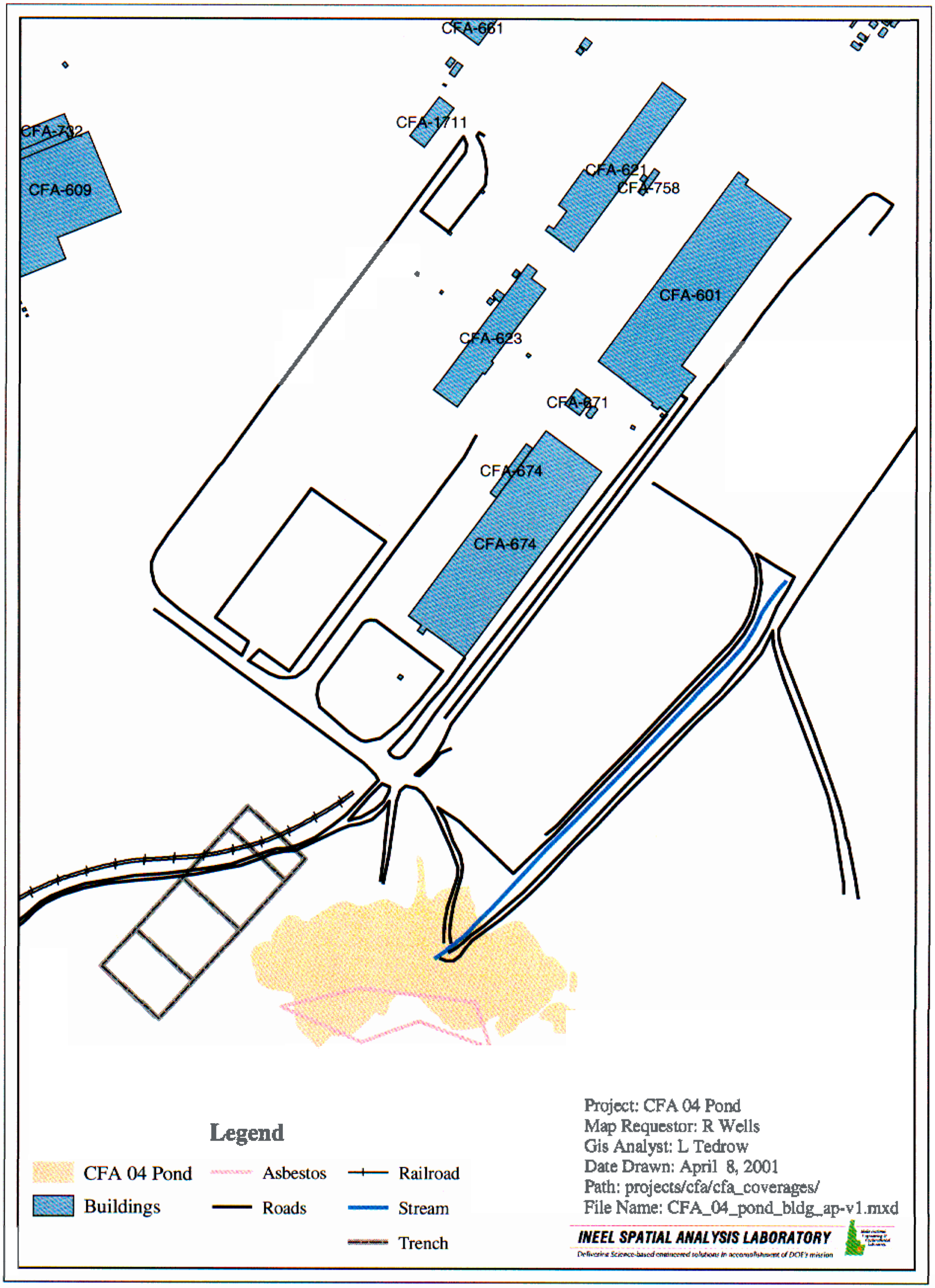

Figure 2-2. CFA-04 pond.

2.3 Project Description

Significant data have previously been collected defining much of the areal and vertical extent of mercury contamination in the CFA-04 pond (refer to Appendix A). Particularly, adequate information is available detailing the contamination levels in the pond surficial soils, much of the bermed area, and the surficial soils in the windblown area. However, data gaps still exist in the definition of the vertical extent of contamination in the pond area and the bermed area along the southern edges of the pond. To aid in the excavation of the soils during the remedial action in an effort to minimize the volume of contaminated soils requiring disposal, additional sampling is required for mercury analysis.

Chromium and silver have been detected in soil samples collected from the pond at maximum concentrations of 237 mg/kg and 121 mg/kg, respectively. Applying the 20X rule of dilution to the total metal results provides a conservative estimate of 11.8 mg/L and 6.0 mg/L, respectively, both of which exceed the characteristic limits of 5.0 mg/L for both chromium and silver. Therefore, it is necessary to determine whether any of the soils to be remediated for mercury contamination are characteristic for either chromium or silver as this will affect the final disposal pathway.

Likewise, there are some soils that exceed background concentrations for radionuclides. Of specific concern are those areas of the pond where mercury concentrations exceed the 260 mg/kg regulatory limit requiring treatment of the contaminated soils by retort (40 CFR 268.40). It must be determined whether those soils that potentially exceed this limit also contain radionuclides with concentrations exceeding background as this will also affect the final disposal pathway.

As it is the intent of the CFA-04 project to dispose of the contaminated soils at the INEEL CERCLA Disposal Facility (ICDF), data are required to support the waste acceptance criteria for that facility. The data generated from this sampling effort will be used to define a three-dimensional representation of the contamination zones within the CFA-04 pond that will ultimately be used to direct the excavation of the soils during the remedial action. This three-dimensional representation will describe the vertical extent of contamination within each zone allowing for the project to determine the required excavation depth within the areal boundary of a zone.

3. SAMPLING OBJECTIVES

Data needs and DQOs for conducting the proposed sampling at CFA-04 are defined in the following sections. Data needs have been determined through the evaluation of existing data and the projection of data requirements anticipated for the analysis of samples collected during the CFA-04 pre-remediation sampling effort.

3.1 Data Quality Objectives

The DQOs were developed following the seven-step process outlined in the *Guidance for the Data Quality Objectives Process* (EPA 1994). The DQOs developed in these sections provide the basis for the sampling to be performed. Section 4 provides a summary of the sampling locations, frequencies, and analytical requirements. The following team members contributed to this DQO process:

Stephen G. Wilkinson	WAG 4 Project Manager
Christine M. Hiaring	WAG 4 Deputy Project Manager
Douglas H. Preussner	WAG 4 Project Engineer
Deborah W. Wagoner	WAG 4 Technical Task Leader
Richard P. Wells	Advisory Scientist

3.1.1 Problem Statement

The objective of DQO Step 1 is to use relevant information to clearly and concisely state the problem to be resolved. There are two basic parts to the problem. First, the areal and vertical extent of the mercury contamination in the CFA-04 pond need to be refined to allow for better direction of the excavation effort during remediation of the site. Second, additional data are required to determine the final disposition paths for the soils to be excavated. The problem statements associated with this DQO process step are:

- Problem Statement 1—Extent of contamination: Refine the definition of the vertical extent of contamination to provide better direction for the remediation excavation effort.
- Problem Statement 2—Disposition pathways: Obtain data necessary to determine the final treatment and/or disposal of contaminated soils excavated from the CFA-04 pond.
- Problem Statement 3—Risk-based concentrations: Determine whether the assumptions used in calculating the preliminary remediation goals are valid.

3.1.2 Decision Identification

The goal of DQO Step 2 is to define the questions that the study will attempt to resolve and to identify the alternative actions that may be taken based on the outcome of the study. Alternative actions are those actions resulting from the resolution of the stated principal study questions (PSQs). The types of alternative actions considered depend on the answers to the PSQs. The PSQs and their corresponding alternative actions will then be joined to form decision statements. The PSQs, alternative actions, and resulting decision statements (DSs) for CFA-04 pre-remediation sampling are provided in Table 3-1.

Table 3-1. Summary of DQO Step 2 information.

Alternative Action	Error Associated with Incorrect Action	Consequences of Error	Severity of Consequences
PSQ #1—What are the vertical boundaries of the pond where the mercury concentrations exceed the final remediation goal of 8.4 mg/kg?			
The vertical contamination boundaries are properly defined delineating the extent of mercury contamination exceeding the remediation goal of 8.4 mg/kg.	Vertical contamination boundaries are erroneously determined to be smaller than should be.	Contaminated soils exceeding the remediation goal of 8.4 mg/kg lie outside the defined boundaries with soils exceeding the remediation goal remaining at the site following excavation.	Moderate
The vertical contamination boundaries are not properly defined delineating a larger extent of mercury contamination exceeding the remediation goal of 8.4 mg/kg.	Vertical contamination boundaries are erroneously determined to be larger than should be.	Contaminated soils exceeding the remediation goal of 8.4 mg/kg are well within the defined boundaries with soils not exceeding the remediation goals being excavated for disposal.	Moderate
DS #1—Verify and refine the vertical extent of mercury contamination in the CFA-04 pond.			
PSQ #2a—Do the soils exceed the TCLP[a] limits for mercury, chromium, or silver?			
Alternative Action	Error Associated with Incorrect Action	Consequences of Error	Severity of Consequences
Soils to be excavated are identified as being characteristic for mercury, chromium, or silver and stabilized for disposal in the ICDF.	Soils to be excavated are erroneously identified as being characteristic.	Soils are unnecessarily stabilized prior to disposal.	Moderate
Soils to be excavated are not identified as being characteristic for mercury, chromium, or silver and are direct-disposed in the ICDF.	Soils to be excavated are erroneously identified as not being characteristic.	Soils are inappropriately disposed of in the ICDF.	High
DS #2a—Based upon the analytical data, determine whether any of the key contaminants are RCRA-characteristic.			
PSQ #2b—Do the soils that exceed 260-mg/kg total mercury contain elevated concentrations of radionuclides?			

Table 3-1. (continued).

Alternative Action	Error Associated with Incorrect Action	Consequences	Severity of Consequences
Soils that exceed 260-mg/kg total mercury and are to be excavated are identified as containing elevated concentrations of radionuclides.	Soils exceeding 260-mg/kg total mercury and are to be excavated are erroneously identified as containing elevated concentrations of radionuclides.	Alternative disposal options are evaluated for treatment of the waste stream.	Moderate
Soils that exceed 260-mg/kg total mercury and are to be excavated are identified as not containing elevated concentrations of radionuclides.	Soils exceeding 260-mg/kg total mercury and are to be excavated are erroneously identified as not containing elevated concentrations of radionuclides.	Soils are sent to an off-Site retort treatment facility not licensed for radiologically contaminated materials.	High
DS #2b—Based upon the analytical data, determine whether any soils that are greater than 260-mg/kg total mercury also contain elevated levels of radionuclides.			
PSQ #3—What are the methyl mercury concentrations in the contaminated soils?			
Alternative Action	Error Associated with Incorrect Action	Consequences	Severity of Consequences
Methyl mercury concentrations are determined to be less than or equal to the concentration used in calculating the risk associated with the final remediation goal.	The methyl mercury concentrations are erroneously determined to be less than or equal to that used in determining the final remediation goal.	Risk associated with soils remaining at the site exceeds the final remediation goal.	High
Methyl mercury concentrations are determined to be greater than the concentration used in calculating the risk associated with the final remediation goal.	The methyl mercury concentrations are erroneously determined to be greater than that used in determining the final remediation goal.	The final remediation goal is recalculated requiring the excavation of soils that do not pose an unacceptable risk.	Moderate
DS #3—Based on the analytical data, determine whether the methyl mercury concentrations validate the assumptions used in calculating the risk-based concentrations.			
a. TCLP = toxicity characteristic leaching procedure			

3.1.3 Identify Inputs to the Decision

The purpose of DQO Step 3 is to identify the type of data needed to resolve each of the decision statements identified in DQO Step 2. These data may already exist or may be derived from computational or surveying/sampling and analysis methods. Analytical performance requirements (e.g., practical quantitation limits [PQLs], precision, and accuracy) are also provided in this step for any new data that will be collected.

3.1.3.1 Information Required to Resolve Decision Statements. Table 3-2 specifies the information (data) required to resolve each of the decision statements identified in Section 3.1.2 and identifies whether these data already exist. For the data that are identified as existing, the source references for the data have been provided with a qualitative assessment as to whether the data are of sufficient quality to resolve the corresponding decision statement. The qualitative assessment of the existing data was based on the evaluation of the corresponding quality control (QC) data (e.g., spikes, duplicates, and blanks), detection limits, data collection methods, etc.

Table 3-2. Required information and reference sources.

DS #	Measurement Variable	Required Data	Do Data Exist?	Source Reference	Sufficient Quality?	Additional Information Required?
1	Mercury concentrations	Laboratory measurements of contaminant	Yes	RI/FS	No	Yes
2a	TCLP metal concentrations	Laboratory measurements of potential contaminants	Yes	RI/FS	No	Yes
2b	Radionuclide concentrations	Laboratory measurements of potential contaminants	Yes	RI/FS	No	Yes
3	Methyl mercury concentrations	Laboratory measurements of potential contaminant	No	—	No	Yes

3.1.3.2 Basis for Setting the Action Level. The action level is the threshold value that provides the criterion for choosing between alternative actions. For Decision Statement 1, the contaminant of concern is mercury. For Decision Statement 2a, the potential contaminants are mercury, chromium, and silver. For Decision Statement 2b, the potential contaminants are Cs-137, Pa-234m, Sr-90, Th-234, U-234, U-235, and U-238. For Decision Statement 3, the potential contaminant is methyl mercury. For Decision Statement 1, the basis for setting the action level is the final remediation goal of 8.4 mg/kg. For Decision Statement 2a, the basis is the maximum concentration of contaminants for the toxicity characteristic, as defined in 40 Code of Federal Regulations (CFR) 261.24, Table 1. For Decision Statement 2b, the bases for setting the action levels are the background concentrations at the INEEL, as found in the *Background Dose Equivalent Rates and Surficial Soil Metal and Radionuclide Concentrations for the Idaho National Engineering Laboratory* (INEEL 1996b). For Decision Statement 3, the basis for setting the action level is the risk-based concentration assuming 0.5% methylation of available mercury. The numerical values for the action levels are provided in DQO Step 5.

3.1.3.3 Computational and Survey/Analytical Methods. Table 3-3 identifies the decision statements where existing data either do not exist or are of insufficient quality to resolve the decision statements. For these decision statements, Table 3-3 presents computational and surveying/sampling methods that could be used to obtain the required data. For Decision Statements 1, 2b, and 3, analytical data will be collected to determine the total concentrations of contaminants. For Decision Statement 2a, analytical data will be collected following the prescribed extraction methodology for the toxicity characteristic. For Decision Statement 3, additional statistical analyses will be used to determine the correlation of the methyl mercury data set to the total mercury data obtained from the same samples, thereby allowing a direct comparison of methyl mercury to total mercury concentrations.

Table 3-3. Information required to resolve the decision statements.

DS #	Measurement Variable	Required Data	Computational Methods	Survey/Analytical Methods
1	Mercury	Total mercury concentrations in soils	Determine spatial mercury concentrations	Analytical laboratory determination of mercury concentrations in soils
2a	Mercury, chromium, and silver	TCLP metal concentrations in soils	Compare TCLP metal concentrations to the regulatory levels	Analytical laboratory determination of TCLP metal concentrations in soils
2b	Cs-137, Pa-234m, Sr-90, Th-234, U-234, U-235, and U-238	Radionuclide concentrations in soils	Compare radionuclide concentrations to background levels	Analytical laboratory determination of radionuclide concentrations in soils
3	Methyl mercury	Methyl mercury concentrations in soils	Determine methyl mercury concentrations	Analytical laboratory determination of methyl mercury concentrations in soils

3.1.3.4 Analytical Performance Requirements. Table 3-4 defines the analytical performance requirements for the data that need to be collected to resolve each of the decision statements. These performance requirements include PQL, precision, and accuracy requirements for each of the contaminants.

3.1.4 Study Boundaries

The primary objective of DQO Step 4 is to identify the population of interest, define the spatial and temporal boundaries that apply to each decision statement, define the scale of decision-making, and identify any practical constraints (hindrances or obstacles) that must be taken into consideration in the sampling design. Implementing this step ensures that the sampling design will result in the collection of data that accurately reflect the true condition of the site under investigation.

3.1.4.1 Geographic Boundaries. Limiting the geographic boundaries of the study area ensures that the investigation does not expand beyond the original scope of the task. This study will focus on the CFA-04 pond at WAG 4. Based upon a review of the existing data, the collections of samples from selected sites in this area will satisfy the decision statements defined for DQOs.

Table 3-4. Analytical performance requirements.

DS #	Analyte List	Survey/ Analytical Method	Preliminary Action Level	PQL	Precision Requirement	Accuracy Requirement
1	Mercury	SW-846	8.4 mg/kg	0.04 mg/kg	± 30%	70–130%
2a	TCLP mercury TCLP chromium TCLP silver	SW-846	0.2 mg/L 5.0 mg/L 5.0 mg/L	0.2 μg/L 10 μg/L 10 μg/L	± 20%	80–120%
2b	Cs-137 Pa-234m Sr-90 Th-234 U-234 U-235 U-238	Gamma Spec Gamma Spec GFPC[a] Gamma Spec Alpha Spec Alpha Spec Alpha Spec	0.44 pCi/g 1.04 pCi/g[b] 0.26 pCi/g 1.04 pCi/g[b] 1.03 pCi/g 0.048 pCi/g[c] 1.04 pCi/g	0.1 pCi/g d 0.1 pCi/g d 0.05 pCi/g 0.05 pCi/g 0.05 pCi/g	± 30%	70–130%
3	Methyl mercury	SW-846 (modified)	0.042 mg/kg	0.04 mg/kg	± 30%	70–130%

a. GFPC = gas-flow proportional counting

b. The action level was determined based upon the assumption that Pa-234m and Th-234 would be in secular equilibrium with U-238.

c. The action level was calculated based upon the naturally-occurring isotopic ratio of U-235 to U-238 and the average concentration of U-238 in INEEL soils.

d. Based on Cs-137, all other gamma-emitting isotopes have a detection limit commensurate with their photon yield and energy as related to the Cs-137 detection limit.

3.1.4.2 Temporal Boundaries. The temporal boundary refers to the time frame to which each decision statement applies (e.g., number of years) and when (e.g., season, time of day, weather conditions) the data should optimally be collected. Temporal boundaries are important when contaminant concentration changes over time are significant. There is no temporal component to the CFA-04 pond pre-remediation sampling, although it could be argued that sampling during the hotter summer months or those months during which soil moisture levels are higher could adversely affect the analytical results. Sampling will be conducted in late spring/early summer allowing for soils to dry following the spring run-off and prior to the hotter months of summer.

3.1.4.3 Scale of Decision-Making. The scale of decision-making is defined by joining the population of interest and the geographic and temporal boundaries of the area under investigation. For the CFA-04 pre-remediation sampling, the scale of decision-making is the same as the geographic boundary defined in Section 3.1.4.1.

3.1.4.4 Practical Constraints. Practical constraints may include physical barriers, difficult sample matrices, high radiation areas, or any other condition that will need to be taken into consideration in the design and scheduling of the sampling program. For the CFA-04 pre-remediation sampling, there are no practical constraints to be considered.

3.1.5 Develop a Decision Rule

The purpose of DQO Step 5 is initially to define the statistical parameter of interest (mean, 95% upper confidence level, etc.) that will be used for comparison against the action level. Table 3-5 summarizes the decision rules (DRs) for the two decision statements provided in Section 3.1.2. These DRs summarize the attributes the decision-maker needs to know about the sample population and how this knowledge will guide the selection of a course of action to solve the problem.

Table 3-5. Decision rules.

DS #	DR #	Decision Rule
1	1	**If** the mercury concentrations for soil samples collected in the pond exceed the final remediation goal of 8.4 mg/kg, **then** soils will be excavated. Otherwise, the soils will be left in place.
2a	2a	**If** the TCLP concentrations for any of the three contaminants exceed the RCRA toxicity characteristic levels defined in 40 CFR 261.24, **then** the contaminated soils will require stabilization prior to disposal. Otherwise, the soils will be directly disposed of at the ICDF without stabilization.
2b	2b	**If** the concentrations of any of the radionuclides exceed the INEEL background concentrations, **then** an alternative disposal option will be identified for those soils requiring treatment by retort. Otherwise, the soils will be disposed of at the ICDF.
3	3	**If** the methyl mercury concentrations of soil samples collected in the pond exceed the assumed concentrations used in the risk estimates, **then** the final remediation goal for mercury will need to be recalculated. Otherwise, a final remediation goal of 8.4 mg/kg will be used.

3.1.6 Decision Error Limits

Because analytical data can only estimate the true condition of the site under investigation, decisions that are made based on measurement data could potentially be in error (i.e., decision error). For this reason, the primary objective of DQO Step 6 is to determine which decision statements (if any) require a statistically-based sample design. The purpose of determining the decision error limits is to specify the decision-maker's tolerable limits on decision errors, which are used to establish performance goals for the data collection design.

Tolerable error limits assist in the development of sampling designs to ensure that the spatial variability and sampling frequency are within specified limits. However, the sampling design for the CFA-04 pre-remediation sampling is determined by sample locations and concentrations of the historical sampling events. The selection of the collection locations for the pre-remediation sampling is based on professional judgment rather than statistics. Therefore, error limits are not used in determination of sampling locations or frequency.

The decision statements defined herein will be resolved using a non-statistical design. Therefore, there is no need to define the "gray region" or the tolerable limits on the decision error, since these only apply to statistical designs.

3.1.7 Optimize the Design

The objective of DQO Step 7 is to present alternative data collection designs that meet the minimum data quality requirements, as specified in DQO Steps 1 through 6. A selection process is then used to identify the most resource-effective data collection design that satisfies all of the data quality requirements.

For the CFA-04 mercury pond, sampling will occur within zones established throughout the area. The objective is to obtain analytical results that are representative of the average contaminant concentrations in each zone. Therefore, four core samples will be collected within each zone with subsamples of each core composited to provide analytical samples that are representative of specified depths. This will allow for a determination of average contamination by depth in a zone and provide a concentration gradient for the zone. Ultimately, the information obtained for each of the zones will be used to delineate the depth and areas for excavation in a three-dimensional fashion allowing for treatment and disposal of the soils based upon these analytical data. More specifically, soils will be excavated to below the deepest interval that is greater than the final remediation goal. The excavated soil waste characteristics will be determined by averaging the composited zone results for each applicable 30-cm (1-ft) interval.

The operational details, rationale, and approach for the final selected sampling design are provided in Table 3-6.

Table 3-6. Operational details of sampling.

Pre-Remediation Sampling Phase	
Media	Soils
Method of Analysis	Laboratory analyses
Sampling Method	Collect four continuous core samples within specified zones and composite analytical samples representing each 30-cm (1-ft) interval within the zone.
Implementation Design	Divide the CFA-04 pond into 13 zones. The size of each zone is based on historical mercury analytical data. Divide each zone into four quadrants obtaining a continuous core sample from each quadrant. Composite the samples from the cores that are representative of each 30-cm (1-ft) interval of the cores. Submit the composite samples for the specified analyses.
Rationale	Dividing the pond into zones based on historical analytical data will allow for decisions to be made regarding waste disposition for soils within discrete zones. Submission of composite samples will reduce analytical costs.

3.2 QA Objectives for Measurement

The quality assurance (QA) objectives for measurement will meet or surpass the minimum requirements for data quality indicators established in the QAPjP (DOE-ID 2000a). This reference provides minimum requirements for the following measurement quality indicators: precision, accuracy, representativeness, completeness, and comparability. Precision, accuracy, and completeness will be calculated per the QAPjP (DOE-ID 2000a).

3.2.1 Precision

Precision is a measure of the reproducibility of measurements under a given set of conditions. In the field, precision is affected by sample collection procedures and by the natural heterogeneity encountered in the environment. Overall precision (field and laboratory) can be evaluated by the use of duplicate samples collected in the field. Greater precision is typically required for analytes with very low action levels that are close to background concentrations.

Laboratory precision will be based upon the use of laboratory-generated duplicate samples or matrix spike/matrix spike duplicate samples. Evaluation of laboratory precision will be performed during the method data validation process.

Field precision will be based upon the analysis of collected field duplicate or split samples. For samples collected for laboratory analyses, a field duplicate will be collected at a minimum frequency of 1 in 20 environmental samples.

3.2.2 Accuracy

Accuracy is a measure of bias in a measurement system. Laboratory accuracy is demonstrated using laboratory control samples, blind QC samples, and matrix spikes. Evaluation of laboratory accuracy will be performed during the method data validation process. Sample handling, field contamination, and the sample matrix in the field affect overall accuracy. To assess false positive or high-biased sample results, the results from field blanks and equipment rinsates will be evaluated.

3.2.3 Representativeness

Representativeness is a qualitative parameter that expresses the degree to which the sampling and analysis data accurately and precisely represent the characteristic of a population parameter being measured at a given sampling point or for a process or environmental condition. Representativeness will be evaluated by determining whether measurements are made and physical samples are collected in such a manner that the resulting data appropriately measure the media and phenomenon measured or studied. The comparison of all field and laboratory analytical data sets obtained throughout this remedial action will be used to ensure representativeness.

3.2.4 Detection Limits

Detection limits will meet or exceed the risk-based or decision-based concentrations for the contaminants of concern. Detection limits will be as specified in the Sampling and Analysis Management (formerly the Sample Management Office) laboratory Master Task Agreement statements of work, task order statements of work, and as described in the QAPjP (DOE-ID 2000a).

3.2.5 Completeness

Completeness is a measure of the quantity of usable data collected during the field sampling activities. The QAPjP (DOE-ID 2000a) requires that an overall completeness goal of 90% be achieved for non-critical samples. If critical parameters or samples are identified, a 100% completeness goal is specified. Critical data points are those sample locations or parameters for which valid data must be obtained in order for the sampling event to be considered complete.

The end use of the data generated as a result of this sampling activity serves three purposes as discussed in Section 3.1.1. Because one of the primary purposes of the data is to determine the final disposition of the soils, the data will be considered critical with a completeness goal of 100%.

3.2.6 Comparability

Comparability is a qualitative characteristic that refers to the confidence with which one data set can be compared to another. At a minimum, comparable data must be obtained using unbiased sampling designs. If sampling designs are not unbiased, the reasons for selecting another design should be well documented. Data comparability will be assessed through the comparison of all data sets collected during this study using the following parameters:

- Data sets will contain the same variables of interest
- Units will be expressed in common metrics
- Similar analytical procedures and QA will be used to collect data
- Time of measurements of variables will be similar
- Measuring devices will have similar detection limits
- Samples within data sets will be selected in a similar manner
- Number of observations will be of the same order of magnitude.

3.3 Data Validation

Method data validation is the process whereby analytical data are reviewed against set criteria to ensure that the results conform to the requirements of the analytical method and any other specified requirements. All of the laboratory-generated analytical data will be reviewed per INEEL Guide (GDE)-7003, “Levels of Analytical Method Data Validation.” A cursory review of the laboratory data will be performed to ensure that contractual requirements have been met.

Field-generated data will not be validated. Quality of the field-generated data will be ensured through adherence to established operating procedures and use of equipment calibration, as appropriate.

4. SAMPLING LOCATION AND FREQUENCY

The material presented in this section is intended to support the DQOs summarized in Section 3.

4.1 Quality Assurance/Quality Control Samples

The QA samples will be included to satisfy the QA requirements for the field operations per the QAPjP (DOE-ID 2000a). The duplicate, blank, and calibration quality assurance/quality control (QA/QC) samples will be analyzed, as outlined in Section 3.

4.2 Sampling Frequency

Samples will be collected representing 30-cm (1-ft) intervals with the final sample collected at the depth representing the bottom of the core sample.

As an example, the basalt underlying Zone 3 may be 1.83 m (6 ft) deep. Four cores will be collected within the zone and samples of each core collected from 0 to 30 cm (0 to 1 ft), 30 to 61 cm (1 to 2 ft), 61 to 91 cm (2 to 3 ft), 91 cm to 1.22 m (3 to 4 ft), 1.22 to 1.52 m (4 to 5 ft), and 1.52 to 1.83 m (5 to 6 ft). The 0 to 30-cm (0 to 1-ft) samples of each core will be composited to provide one analytical sample to be submitted to the laboratory, as will the samples from each of the other depth intervals.

A seismic refraction survey of the CFA-04 pond area was performed to determine the depth to rock. An estimated 1,280 m (4,200 ft) of seismic refraction profile data were acquired along profiles spaced 30 m (100 ft) apart with depth determinations made at a 2-m (6.56-ft) spacing along the total profile length. From these profile data, a depth-to-rock contour map was generated (see Figure 4-1). From this map, the depth to rock can be estimated for a given core sampling location, thereby enabling the sampling team to calculate the number of subsamples to be expected from a given location given the intervals prescribed above.

It is realized that the depths of each of the four cores within a given zone will vary. Only the cores that reach a given depth interval will be used to form the composite analytical sample for that interval. For example, if two cores reach a depth of 2.44 m (8 ft), these two cores will be used to create the composite sample for that depth.

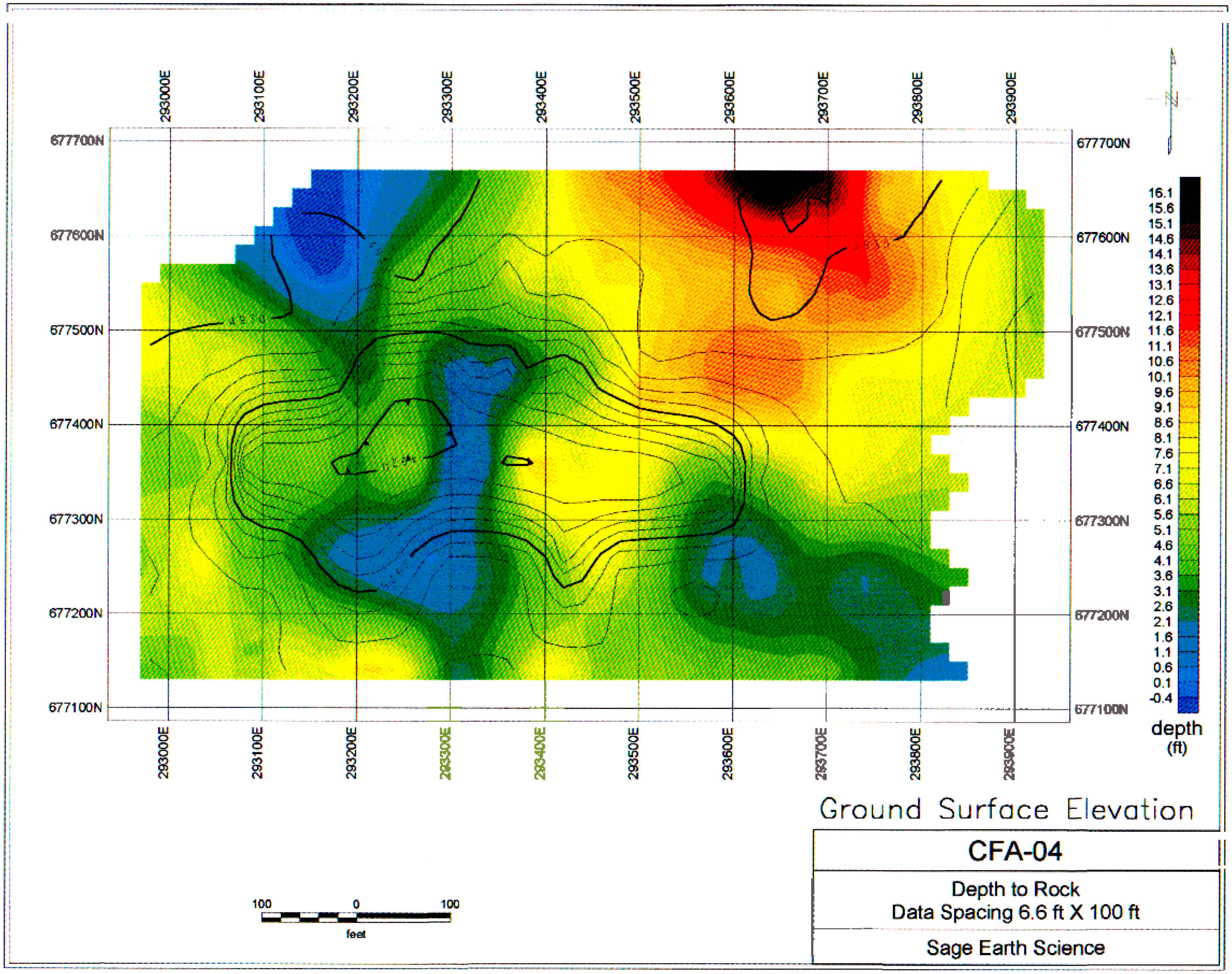

Figure 4-1. CFA-04 ground surface elevations—depth to rock.

4.3 Sampling Locations

For sampling purposes, the CFA-04 pond area has been subdivided into 14 zones (see Figure 4-3). The zones were defined based upon the source of contamination and similarity of mercury concentrations. For all the zones within the pond area, the sources of contamination are assumed to be waste calcine disposed to the pond, as well as mercury-containing waste water that was pumped to the pond and allowed to percolate down through the pond sediments. Zone 11 also includes asbestos-containing roofing materials that pose a potential hazard to sampling team members. Extra precautions should be taken when sampling in these areas in accordance with the HASP (INEEL 2002). The predominant source of contamination in Zone 1 is believed to be a result of the mercury retort activities that took place in the mid-1990s. The contamination in Zone 2 is attributed to windblown spread of mercury-containing pond sediments.

The highest mercury concentrations are believed to exist in Zones 7 and 8 based upon historical data. Zone 6 has the potential to have somewhat higher mercury concentrations than the remainder of the pond locations, with Zones 10 and 14 having the lowest mercury concentrations. Likewise, the mercury concentrations in Zone 11 are expected to be relatively low, but as stated earlier, the presence of asbestos poses the greater health risk in this area of the pond.

Figure 4-2 provides the locations where samples have previously been collected. The locations are segregated by those with concentrations below the final remediation goal of 8.4 mg/kg total mercury, those with concentrations ranging from 8.4 to 260 mg/kg, and locations with concentrations greater than 260 mg/kg. Figure 4-3 graphically delineates the sampling zones and the four proposed core locations within each zone. The zones were derived based upon the total mercury concentrations obtained from the historical sampling events. The coordinates will be based on the State Plane, Idaho East, Units Feet, North American Datum-27 system.

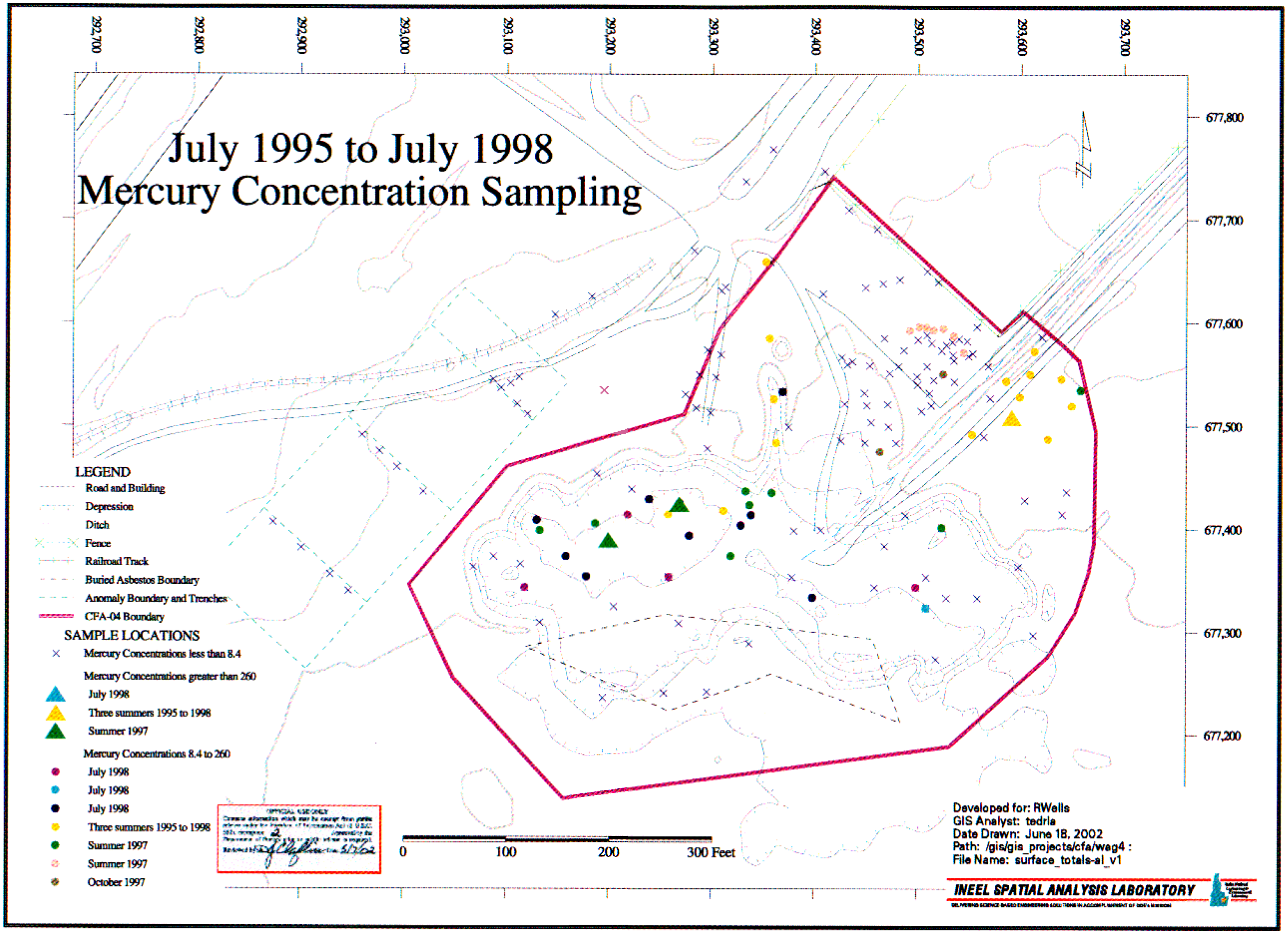

Figure 4-2. Historical mercury concentrations.

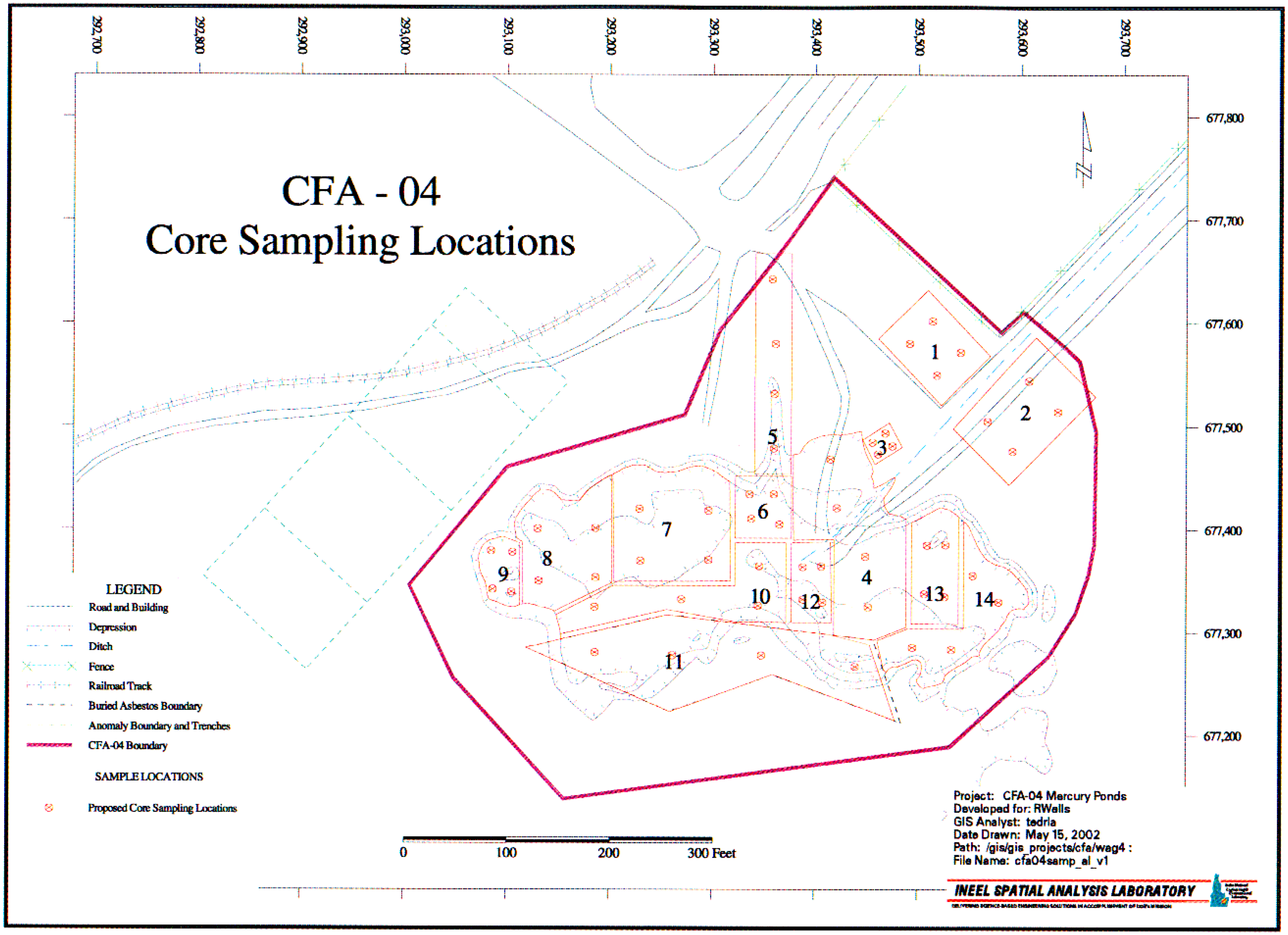

Figure 4-3. CFA-04 sampling locations.

5. SAMPLING DESIGNATION

5.1 Sample Identification Code

A systematic character identification (ID) code will be used to uniquely identify all laboratory samples. Uniqueness is required for maintaining consistency and preventing the same ID code from being assigned to more than one sample.

The first three designators of the code will always be **4**, **P**, and **4**. The first **4** refers to the sample as originating from WAG 4. The **P** refers to the sample being collected in support of the pre-remediation sampling effort. The next **4** refers to the sample being collected from CFA-04. The next three numbers designate the sequential sample number for the project. A two-character set (i.e., 01, 02) will then be used to designate field duplicate samples. The last two characters refer to a particular analysis and bottle type. Refer to the SAP tables in Appendix B for specific bottle code designations.

For example, a soil sample collected in support of determining the metals concentration of a target analyte list might be designated as 4P400101HG where (from left to right):

- **4** designates the sample as originating from WAG 4
- **P** designates the sample as being collected in support of the pre-remediation sampling effort
- **4** designates the sample as being collected from CFA-04
- **001** designates the sequential sample number
- **01** designates the type of sample (01 = original, 02 = field duplicate)
- **HG** designates mercury analysis.

A SAP table/database will be used to record all pertinent information associated with each sample ID code.

5.2 Sampling and Analysis Plan Table/Database

A SAP table format was developed to simplify the presentation of the sampling scheme for project personnel. The following sections describe the information recorded in the SAP table/database, which is presented in Appendix B.

5.2.1 Sample Description

The sample description fields contain information relating individual sample characteristics.

5.2.1.1 Sampling Activity. The sampling activity field contains the first six characters of the assigned sample number. The sample number in its entirety will be used to link information from other sources (field data, analytical data, etc.) to the information in the SAP table for data reporting, sample tracking, and completeness reporting. The analytical laboratory will also use the sample number to track and report analytical results.

5.2.1.2 Sample Type. Data in this field will be selected from the following:

REG	for a regular sample
QC	for a QC sample.

5.2.1.3 Media. Data in this field will be selected from the following:

SOIL	for soil samples
WATER	for QA/QC water samples.

5.2.1.4 Collection Type. Data in this field will be selected from the following:

GRAB	for grab sample collection
COMP	for composite sample collection
RNST	for rinsate QA/QC samples
DUP	for field duplicate samples
FBLK	for field blank QA/QC samples.

5.2.1.5 Planned Date. This date is related to the planned sample collection start date.

5.2.2 Sample Location Fields

This group of fields pinpoints the exact location for the sample in three-dimensional space, starting with the general AREA, narrowing the focus to an exact location geographically, and then specifying the DEPTH in the depth field.

5.2.2.1 Area. The AREA field identifies the general sample collection area. This field should contain the standard identifier for the INEEL area being sampled. For this investigation, samples are being collected from CFA, and the AREA field identifier will correspond to this site.

5.2.2.2 Location. The LOCATION field may contain geographical coordinates, x-y coordinates, building numbers, or other location-identifying details, as well as program-specific information such as borehole or well number. Data in this field will normally be subordinated to the AREA. This information is included on the labels generated by the Sampling and Analysis Management (formerly the Sample Management Office) to aid sampling personnel.

5.2.2.3 Type of Location. The TYPE OF LOCATION field supplies descriptive information concerning the exact sample location. Information in this field may overlap that in the location field, but it is intended to add detail to the location.

5.2.2.4 Depth. The DEPTH of a sample location is the distance in feet from surface level or a range in feet from the surface.

5.2.3 Analysis Types

5.2.3.1 AT1-AT20. These fields indicate analysis types (radiological, chemical, hydrological, etc.). Space is provided at the bottom of the form to clearly identify each type. A standard abbreviation will also be provided, if possible.

6. SAMPLING PROCEDURES AND EQUIPMENT

The following sections describe the sampling procedures and equipment to be used for the planned sampling and analyses described in this FSP. Prior to the commencement of any sampling activities, a pre-job briefing will be held to review the requirements of the FSP and the project HASP (INEEL 2002) and to ensure all supporting documentation has been completed.

6.1 Sampling Requirements

Requirements for the CFA-04 sampling activity are outlined in the following sections.

6.1.1 Site Preparation

All required documentation and safety equipment will be assembled at the sampling site, including radios, fire extinguishers, personal protective equipment, sample bottles, sampling tools and equipment, drilling equipment, and accessories. All sampling personnel are responsible for having read both this FSP and the project HASP (INEEL 2002) prior to sampling. The field team leader (FTL) will perform a daily site briefing to discuss potential hazards and ensure that all personnel have the required training. The FTL will assign a team member to maintain document control and note this appointment in the FTL's logbook in accordance with MCP-231, "Logbooks for ER and D&D&D Projects."

6.1.2 Sample Collection

As shown in Figure 4-3, the area to be sampled has been subdivided into zones. Each zone will require four core samples. Each core sample will be collected from the surface until the auger meets refusal at the basalt interface. The basalt underlying the pond is fairly undulating—ranging in depth from the basalt outcroppings visible on the southern edge of the pond to an approximate depth of 3 m (10 ft) in a few locations. Following the collection of the core, samples will be subdivided from the core at set intervals. The analytical sample submitted to the laboratory will consist of a composite of the individual core samples collected from a discrete depth within a given zone.

Samples will be collected following the procedures delineated in technical procedure (TPR)-6559, "Sampling with a Hollow-Stem Auger," as well as the requirements set forth in the subcontractor's scope of work and specifications. Much of the area to be sampled is covered with a 15- to 30-cm (6- to 12-in.) layer of gravel. Prior to sampling at a given location, the gravel layer will need to be removed by hand digging prior to using the drill auger. The gravel layer will not require sampling since it was emplaced in 2001 as a fire mitigation method and was not contaminated in the same manner as the pond sediments.

The 11.4 cm (4.5 in.) (nominal) auger will be equipped with a core catcher, a split inner barrel, and a Lexan liner. The auger will be advanced approximately 0.9 m (3 ft) or until refusal, whichever occurs first. The inner split barrel will be recovered with a wireline and the liner retrieved. After removing the inner barrel shoe and head, both ends of the liner will be capped and taped for delivery to the sampling team. A new liner will be installed inside an inner barrel with associated ends and inside augers. The next 0.9 m (3 ft) section of the borehole will be augered. These steps will continue until refusal is encountered at the basalt interface. After the final core section is removed from the borehole, the borehole will be backfilled with residual sample material or non-contaminated gravel or sand.

The sampling team will collect individual sample aliquots using disposable sampling spoons. The aliquots will be placed in certified, pre-cleaned sample containers with an appropriate sample label affixed that has been obtained from Sampling and Analysis Management (formerly the Sample Management Office). Refer to Table 6-1 for the specific sample requirements.

Table 6-1. Specific sample requirements.

Analytical Parameter	Container Size	Type	Preservative	Analytical Method	Holding Time
		Soil/Sediment Samples			
Hg	4 oz	Glass	Cool to 4°C	SW-846 Method 7000 series	28 days for Hg
TCLP Hg/Cr/Ag	8 oz	Glass	Cool to 4°C	SW-846 Method 1311/ 7000 series	28 days for Hg, 6 months for Cr and Ag
Radionuclides	16 oz	HDPE[a]	None	Radiochemical	6 months
Methyl mercury	4 oz	Glass	Cool to 4°C	EPA Method 1630	28 days for Hg
		Liquid Samples (Equipment Rinsates)			
Hg/Cr/Ag	1 L	HDPE[a]	HNO_3 to pH< 2, Cool to 4°C	SW-846 Method 7000 series	28 days for Hg, 6 months for Cr and Ag
Radionuclides	2 L	HDPE[a]	HNO_3 to pH<2	Radiochemical	6 months
Methyl mercury	1 L	HDPE[a]	HNO_3 to pH< 2, Cool to 4°C	EPA Method 1630	28 days for Hg

HDPE = high-density polyethylene

6.1.3 Decontamination

All sampling equipment that comes in contact with the sample media will be decontaminated following the procedures delineated in TPR-6575, “Decontaminating Sampling Equipment in the Field.” As components of the drill rig may become contaminated during the sampling process, decontamination of those components will be performed following the procedures outlined in TPR-6574, “Decontaminating Heavy Equipment in the Field.” Dry decontamination methods will be used to the extent practicable to minimize the generation of liquid decontamination waste.

6.1.4 Mercury Field Screening

Aliquots of the laboratory samples intended for total mercury analysis will be retained for screening for mercury content using a field analytical technique. This will determine the efficacy of using the field method for determining whether the remediation goals have been met when performing the remedial action and also for ensuring that the waste acceptance criteria of the treatment and/or disposal facility are met when shipping contaminated soils offsite. The specific field portable instrument operates on the principal of thermal decomposition of the sample allowing for direct detection of mercury using atomic absorption spectrometry. A statistical correlation study of the field data to laboratory analytical data will be performed to ascertain the instrument’s viability in meeting the project’s goals.

6.1.5 Shipping Screening

Given that the radionuclide contamination is at background levels for CFA-04, radiological control (RadCon) screening methods will suffice for screening. In the event that a sample is questionable, it may be submitted to the Radiation Measurements Laboratory located at the Test Reactor Area at the INEEL for a 20-minute gamma screen prior to shipment. Gamma screening will require that a separate sample be collected for analysis.

6.1.6 Sample Shipping

Samples will be transported in accordance with the regulations promulgated in 49 CFR Parts 171 through 178 and EPA sample handling, packaging, and shipping methods delineated in 40 CFR 262 Subpart C and 40 CFR 263. Additional information pertaining to sample shipping is found in MCP-3480, "Environmental Instructions for Facilities, Processes, Materials, and Equipment." All samples will be packaged and transported to protect the integrity of the samples and prevent sample leakage.

Upon receipt, laboratory personnel will verify the condition of the samples, including temperature (if samples are required to be shipped under controlled-temperature conditions). The laboratory will communicate any discrepancies to the field personnel and the project through Sampling and Analysis Management (formerly the Sample Management Office). The project personnel will determine the appropriate corrective action on a case-by-case basis.

6.2 Handling and Disposition of Remediation Waste

Characterization waste will be generated during the sampling activities, as described herein. The disposition and handling of waste for this project will be consistent with the *Waste Certification Plan for the Environmental Restoration Program* (INEEL 1997). Samples will be handled in accordance with MCP-3480, "Environmental Instructions for Facilities, Processes, Materials, and Equipment." All waste streams generated from the sampling activity will be characterized in accordance with MCP-62, "Waste Generator Services – Low-Level Waste Management," and will be handled, stored, and disposed of accordingly.

All CERCLA-generated waste will be maintained in accordance with the requirements of the previously established CERCLA Waste Storage Unit (CWSU) in which the waste is stored. All CWSUs at the INEEL have been established in accordance with the applicable or appropriate and relevant requirements. This waste shall be maintained in compliant storage until such time as it can be disposed at the ICDF.

Waste will be generated as a result of the sampling activities conducted during this project. Wastes expected to be generated include the following:

- Personal protective equipment
- Liquid decontamination residue
- Solid decontamination residue
- Plastic sheeting
- Unused/unaltered sample material

- Sample containers
- Miscellaneous wastes
- Contaminated equipment.

Wastes may be hazardous. As sampling continues, additional waste streams may be identified. All new waste streams, as well as those identified above, are required to have the waste identified and characterized. A hazardous waste determination must be completed and presented to the appropriate waste management organization (e.g., Waste Generator Services [WGS]) for approval by that organization at the time of generation.

The wastes associated with the sampling activities will be managed in a manner that complies with the established applicable or relevant and appropriate requirements (ARARs), protects human health and the environment, and achieves minimization of remediation waste to the extent possible. The ARARs applicable to the storage of wastes are defined in accordance with the ROD (DOE-ID 2000b). The basic provisions of the ARARs provide for appropriate waste containerization and compliant storage of the wastes for an interim storage period. Protection of human health and the environment is achieved through implementation of the ARARs and through implementation of the waste management approach described herein.

6.2.1 Waste Minimization

Waste minimization techniques will be incorporated into planning and daily work practices to improve worker safety and efficiency. In addition, such techniques will aid in reducing the project environmental and financial liability. Specific waste minimization practices to be implemented during the project will include, but not be limited to::

- Excluding materials that could become hazardous wastes in the decontamination process (if any)
- Controlling transfer between clean and contaminated zones
- Designing containment such that contamination spread is minimized
- Collecting all samples necessary at one time, such that additional wastes are not generated due to resampling.

The *U.S. Department of Energy Idaho Operations Office Idaho National Engineering and Environmental Laboratory Interim Pollution Prevention Plan* (DOE-ID 2000d) addresses the efforts to be expended and the reports required to track waste generated by projects. This plan directs that the volume of waste generated by INEEL operations be reduced as much as possible.

Industrial wastes do not require segregation by type; therefore, containers will be identified as industrial waste and maintained outside the controlled area for separate collection. Industrial waste is defined as solid waste generated by industrial processes and manufacturing. Industrial waste is not radioactive, hazardous, or mixed waste (40 CFR 243.101). Contaminated waste has the potential to be hazardous. This waste will require segregation as either incinerable (e.g., wipes, personal protective equipment) or nonincinerable (e.g., polyvinyl tubing), in anticipation of subsequent waste management. Containers for collection of contaminated waste will be clearly labeled to identify waste type and will be maintained inside the controlled area as defined in the project HASP (INEEL 2002) until removal for subsequent management.

6.2.2 Laboratory Samples

All laboratory and sample waste will be managed in accordance with Sampling and Analysis Management (formerly the Sample Management Office) master task agreements, as part of the contract for the subcontracted laboratory. The laboratory will dispose of any unused sample material. The laboratories are responsible for any waste generated as a result of analyzing the samples. In the event that unused sample material must be returned from the laboratory, only the unused, unaltered samples in the original sample containers will be accepted from the laboratory. These samples will be returned to the waste stream from which they originated. If the laboratory must return altered sample material (e.g., analytical residue), the laboratory will specifically define the types of chemical additives used in the analytical process and assist in making a hazardous waste determination. This information will be provided to the project FTL and environmental compliance coordinator. Management of this waste will also require separation from the other unaltered samples being returned.

6.2.3 Packaging and Labeling

Containers used to store and transport hazardous waste must meet the requirements of 40 CFR 264, Subpart I. The *Idaho National Engineering and Environmental Laboratory Reusable Property, Recyclable Materials, and Waste Acceptance Criteria* (DOE-ID 2001), hereinafter referred to as the RRWAC, contains additional details concerning packaging and container conditions. Appropriate containers for CERCLA waste include 208-L (55-gal) drums and other suitable containers that meet the Department of Transportation's regulations on packaging (49 CFR 171, 173, 178, and 179) or RRWAC Sections 4.4, 4.5, and 4.6. The WGS will be consulted to ensure that the packaging is acceptable to the receiving facility.

Waste containers will be labeled with standard CERCLA remediation waste labels. The following information will be included on the labels:

- Unique bar code serial number
- Name of generating facility (i.e., OU 4-05)
- Phone number of generator contact
- Listed or characteristic waste code(s)
- Waste package gross weight
- Waste accumulation start date
- Maximum radiation level on contact and at 1 m (3 ft) in air
- Waste stream or material identification number as assigned by the receiving facility
- Prior to shipping, other labels and markings as required by 49 CFR 172, Subparts D and E
- Any of the above information that is not known when the waste is labeled may be added when the information is known.

The unique bar code serial number is used for tracking and consists of a five-digit number followed by a single alpha designator. The alpha designator indicates which facility generated the bar code.

Presently, only the Waste Reduction Operations Complex (WROC) generates the bar codes and their alpha designator is “K.” These bar codes will be furnished by WROC in lots of 50. A new bar code will be affixed to each container when waste is first placed in the container.

Any waste shipped off the INEEL from WAG 4 must be labeled in accordance with applicable Department of Transportation labels and markings (49 CFR 172). In addition, waste labels must be visible, legibly printed or stenciled, and placed so that a full set of labels and markings are visible. See the RRWAC (DOE-ID 2001) Section 4.4, 4.5, or 4.6 for additional labeling information.

6.2.4 Storage and Inspection

Wastes may be stored in an established CWSU. Solid wastes segregated as potentially hazardous and/or mixed and placed in 208-L (55-gal) drums will be stored in the CWSU. The wastes will be stored in either one of two CSWUs previously established at the INEEL. These units include CFA-637-101-A located at CFA, and CPP-1789-000-A located at the Idaho Nuclear Technology and Engineering Center. To meet the substantive requirements of 40 CFR 264, Subpart I, the RCRA ARARs inspection of the CWSU will be conducted as part of the weekly waste container inspection. The purposes of the weekly container inspection are to look for containers that are leaking or that are deteriorating due to corrosion or other factors, to ensure that the containment system has not deteriorated due to corrosion and to verify that labels are in place and legible. Inspections of the containers and the CWSU are conducted to meet the guidance contained in MCP-3475, “Temporary Storage of CERCLA-Generated Waste at the INEEL.” The inspections will be documented on a weekly inspection form when completed. The checklists used to guide the inspection will be maintained by WGS.

6.2.5 Personal Protective Equipment

The personal protective equipment requiring disposal may include, but not be limited to, gloves, respirator cartridges, shoe covers, and coveralls. The personal protective equipment will be disposed of in accordance with the requirements set forth in the RRWAC (DOE-ID 2001) and the *Waste Certification Plan for the Environmental Restoration Program* (INEEL 1997).

6.2.6 Hazardous Waste Determinations

All wastes generated will be characterized as required by 40 CFR 262.11. Hazardous waste determinations will be prepared for all waste streams as per the requirements set forth in MCP-62, “Waste Generator Services – Low-Level Waste Management.” Completed hazardous waste determinations will be maintained for all waste streams as part of the project file held by WGS. The hazardous waste determinations may use two approaches to determine whether a waste is characteristic:

1. Process knowledge may be used if there is sufficient existing information to characterize the waste. Process knowledge may include direct knowledge of the source of the contamination and/or existing validated analytical data.

2. Analysis of representative samples of the waste stream may be performed by either specialized RCRA protocols, standard protocols for sampling and laboratory analysis that are not specialized RCRA methods, or other equivalent regulatory approved methods. In addition, process knowledge may influence the amount of sampling and analysis required in order to perform characterization.

Land disposal restrictions for hazardous wastes are addressed in 40 CFR 268. The INEEL-specific requirements for treatment, storage, and disposal are addressed in the RRWAC (DOE-ID 2001). After the hazardous waste determinations are completed, the INEEL Interim Waste Tracking System profile number is assigned and the appropriate information entered into the tracking system.

6.2.7 Waste Disposition

At the conclusion of the investigations, or when deemed necessary, industrial waste will be disposed of in the INEEL landfill, following the protocols and completing the forms identified by the RRWAC (DOE-ID 2001). To achieve this waste management activity, industrial waste will be turned over to CFA operations personnel for management under existing facility waste streams and in accordance with standing facility procedures. When sufficient quantities of waste have been accumulated to ship to one of the INEEL waste management units or off the INEEL to a commercial waste management facility, WGS will be contacted and the appropriate forms will be completed and submitted for approval, as required. The waste generator interface will provide assistance in packaging and transporting the waste.

Waste that is determined to be RCRA-hazardous is not intended to be stored in a permitted treatment, storage, and disposal facility. However, if this becomes necessary, it will be labeled as CERCLA to facilitate eventual management in accordance with CERCLA treatment, storage, or disposal that may become available. Should further characterization of the contaminated waste be necessary, services will be requested from WGS and Sampling and Analysis Management (formerly the Sample Management Office). Requesting these services requires completion of Form 435.26, “SMO/WGS Services Request Form.” For final disposition of RCRA-hazardous waste, WGS will be contacted to determine whether the waste qualifies for disposal under terms of existing Master Task Agreements.

All low-level radioactive and mixed wastes shall be handled and disposed of in accordance with the requirements set forth in the RRWAC (DOE-ID 2001). Care should be taken to ensure that all containers used to store waste or sampling equipment are in a “like-new” condition. Following completion of sampling, the individual waste streams destined for disposal at an on-Site facility will be approved and prepared for disposal in accordance with the requirements of the RRWAC (DOE-ID 2001) and the *Waste Certification Plan for the Environmental Restoration Program* (INEEL 1997). In so much as the various waste streams meet the waste acceptance criteria, the intent is to dispose of them in the ICDF once the facility becomes operational.

Management of contaminated wastes, generated at a subcontract laboratory during analytical testing, will be the responsibility of the subcontract laboratory. However, overall management of the samples must be in accordance with the requirements of MCP-3480, “Environmental Instructions for Facilities, Processes, Materials, and Equipment.” Specifically, MCP-3480 requires the facility environmental, safety, and health manager to provide written approval prior to return of any media and that written documentation of sample disposition be developed and maintained. To initiate the return of these wastes to the INEEL, the subcontract laboratory shall notify Sampling and Analysis Management (formerly the Sample Management Office) in the form of a written report identifying the known volume and characteristics of each waste type, including shipping and packaging details. Final authorization for the return of wastes will be provided in writing, from Sampling and Analysis Management (formerly the Sample Management Office) with concurrence from the technical task manager to the subcontract laboratory. In the event that laboratory wastes are returned, WGS will be contacted and will be responsible for the disposition of those wastes.

Waste streams to be generated during this sampling effort may include the following categories:

- Hg < 260 mg/kg, non-characteristic, non-radiologically contaminated

- Hg < 260 mg/kg, characteristic, non-radiologically contaminated
- Hg > 260 mg/kg, non-characteristic or characteristic, non-radiologically contaminated
- Hg < 260 mg/kg, non-characteristic, radiologically contaminated
- Hg < 260 mg/kg, characteristic, radiologically contaminated
- Hg > 260, non-characteristic or characteristic, radiologically contaminated.

For those wastes contaminated with mercury greater than 260 mg/kg, it does not matter whether the soils are characteristic as the prescribed treatment is retort. The majority of wastes generated during the sampling effort are expected to have mercury contamination levels less than 260 mg/kg, non-characteristic, and non-radiologically contaminated. A smaller subset may be radiologically contaminated, with yet smaller subsets consisting of wastes that are characteristic for mercury or greater than 260 mg/kg.

6.2.8 Record Keeping and Reporting

Records and reports related to waste management are required to be maintained, as indicated by MCP-3475, "Temporary Storage of CERCLA-Generated Waste at the INEEL." Some of these may be completed by others, but must be available either at CFA or with the WAG 4 project files. All information related to the tracking and disposition of wastes generated as a result of the sampling effort will be entered into the Integrated Waste Tracking System which is operated and maintained by WGS. These records shall include, but not be limited to:

- Hazardous waste determinations, characterization information, and statements of process knowledge (by others)
- CWSU and CSA inspection reports and log-in, log-out history
- Training records
- Documentation with respect to all spills.

6.3 Project-Specific Waste Streams

Several distinct waste stream types anticipated to be generated during this project have been identified. Some of these waste types will be clean, but many may be contaminated. Subsequent to generation, any or all of the waste may be reclassified; therefore, the intended waste management strategies for each are outlined below. The following sections describe the expected waste that will require compliant storage and/or disposal, including the intended management strategy from the time of generation until final disposition. Field and laboratory personnel will be responsible for segregating wastes. The anticipated quantities have also been approximated; however, they are to be considered a rough order-of-magnitude because, in some cases, the type of contamination present cannot be determined prior to sampling and analysis. Estimated waste volumes are based on historical sampling activities conducted in support of other CERCLA actions conducted at the INEEL in addition to calculated volumes based upon drawings and discussions with ER personnel.

6.3.1 Personal Protective Equipment

Personal protective equipment in the form of coveralls, leather and rubber gloves, and anti-contamination clothing may be generated for the sampling activities. The anticipated quantity of personal protective equipment to be generated and requiring disposal as a result of the sampling activities is 0.76 m^3 (1 yd^3), classified as clean.

6.3.2 Liquid Decontamination Residue

The decontamination methods for field and sampling equipment will ensure containment of all decontamination fluids, minimize waste, and minimize contamination of equipment. Decontamination fluids will be generated by wet decontamination of field (e.g., drilling equipment) and sampling (e.g., spoons, shovels) equipment. They may contain oil and/or grease in addition to any radionuclide and/or hazardous contamination that may be present. The anticipated quantity of decontamination fluids to be generated and requiring disposal as a result of the sampling activities is 57 L (15 gal), classified based upon the site of origin. To verify the end classification of decontamination fluids, a sample of the rinsate water will be submitted for laboratory analysis. It is intended that the liquid decontamination residues will be consolidated and stabilized for eventual disposal in the ICDF. In the event that the residues do not meet the ICDF's waste acceptance criteria, an alternative treatment and disposal facility will need to be identified.

6.3.3 Solid Decontamination Residue

As with the liquid decontamination residues, solid decontamination methods will ensure the minimization of waste and minimization of equipment contamination. Solid decontamination residues will be generated by the dry decontamination of field and sampling equipment. Dry decontamination methods will be used to the extent practicable to minimize the generation of liquid decontamination residues. The anticipated quantity of solid decontamination residues to be generated and requiring disposal as a result of the sampling activities is 57 L (15 gal), classified based upon the site of origin. The end classification of the solid decontamination residues will be based upon the results of the analytical samples collected from the contaminated source. It is intended that the solid decontamination residues will be consolidated for eventual disposal in the ICDF. In the event that the residues do not meet the ICDF's waste acceptance criteria, an alternative treatment and disposal facility will need to be identified.

6.3.4 Plastic Sheeting

Plastic sheeting may be used as an environmental barrier to contamination and to provide a laydown site for staging equipment and tooling. Based upon historical usage of plastic sheeting at environmental remediation sites, the anticipated volume to be generated and requiring disposal as a result of the sampling activities is 0.76 m^3 (1 yd^3), classified as clean.

6.3.5 Unused/Unaltered Sample Material

Unused/unaltered sample material will be generated from the sampling activities in the form of soils and waters not required for sampling and analysis. In most cases, the analytical laboratory will be responsible for disposal of the unused/unaltered sample material and any wastes generated as a result of analyzing the samples. In the event that unused sample material must be returned from the laboratory, only the unused, unaltered samples in the original sample containers will be accepted from the laboratory. The unused, unaltered sample material will be returned to the point of origin whenever possible. In those instances where sample material cannot be returned to the point of origin, it will be consolidated for disposal at the ICDF.

6.3.6 Analytical Residues

Analytical residues will be generated from the sample analytical activities conducted by subcontracted laboratories. Although the laboratories are required to dispose of analytical residues under terms of the subcontract, the potential does exist for return of the residues, particularly in the case of materials regulated under the Toxic Substances Control Act (TSCA). The potential sources of TSCA-regulated materials at CFA-04 are the asbestos-containing roofing materials buried at the site. Therefore, residues produced by subcontracted laboratories as a result of analyzing samples containing these roofing materials will be returned to the INEEL for final disposition. The anticipated quantity of analytical residues to be generated and requiring disposal as a result of the sampling activities is 57 L (15 gal), classified based upon the site of origin. Any residues returned to the INEEL for disposal will be consolidated for eventual disposal in the ICDF. In the event that the residues do not meet the ICDF's waste acceptance criteria, an alternative treatment and disposal facility will need to be identified.

6.3.7 Sample Containers

Sample containers will become a waste stream following analysis. As with unused/unaltered sample material, the analytical laboratory will be responsible for disposal of the sample containers. In the event that unused sample material must be returned from the laboratory, the samples will be consolidated for disposal and the sample containers, by virtue of the empty container rule, will be disposed of as clean waste.

6.3.8 Hydraulic Spills

A small quantity of hydraulic oil (less than 18.9 L [5 gal]) is expected to be generated during all sampling activities. The waste oil will be collected in drip pans. The collected hydraulic oil will be recycled, if possible, or drummed and sent to an approved disposal facility. Final determination will partially depend on the quantities generated and will be performed by WGS.

In the event of an inadvertent release of hydraulic oil to the environment (e.g., soil spill), the steps for containing and reporting the spill as outlined in Section 11 of the project HASP (INEEL 2002) will be followed. The affected soil will be placed in an appropriate container, sampled for total petroleum hydrocarbon analysis, and sent to an approved disposal facility with approval of WGS. If the spill occurs on contaminated soils, WGS will be contacted for determination of disposal options.

6.3.9 Miscellaneous Wastes

Miscellaneous wastes such as trash, labels, rags, and other miscellaneous debris may be generated during the project. The anticipated quantity of miscellaneous wastes to be generated and requiring disposal as a result of the sampling activities is 1.53 m^3 (2 yd^3), classified as clean. Clean miscellaneous waste will be removed to the CFA landfill.

7. DOCUMENTATION MANAGEMENT AND SAMPLE CONTROL

Section 7.1 summarizes document management and sample control. Documentation includes field logbooks used to record field data and sampling procedures. Section 7.2 outlines the sample handling and discusses chain-of-custody (COC) and radioactivity screening for shipment to the analytical laboratory (if required). The analytical results from this sampling effort will be documented in the semiannual operating/shutdown cycle reports.

7.1 Documentation

The FTL will be responsible for controlling and maintaining all field documents and records, and for ensuring that all required documents are submitted to ER Administrative Records and Document Control. All entries will be made in permanent ink. A single line will be drawn through any error with the correct information entered next to it. All corrections will be initialed and dated.

7.1.1 Sample Container Labels

Waterproof, gummed labels generated from the SAP database will display information such as the sample ID number, the name of the project, sample location, and analysis type. In the field, labels will be completed and placed on the containers before collecting the sample. Information concerning sample date, time, preservative used, field measurements of hazards, and the sampler's initials will be filled out during field sampling.

7.1.2 Field Guidance Forms

Field guidance forms, provided for each sample location, will be generated from the SAP database, to ensure unique sample numbers. Used to facilitate sample container documentation and organization of field activities, these forms contain information regarding the following:

- Media
- Sample ID numbers
- Sample location
- Aliquot ID
- Analysis type
- Container size and type
- Sample preservation.

7.1.3 Field Logbooks

In accordance with Administrative Records and Document Control format, field logbooks will be used to record information necessary to interpret the analytical data. All field logbooks will be controlled and managed according to MCP-231, "Logbooks for ER and D&D&D Projects."

7.1.3.1 Sample Logbooks. Sample logbooks will be used by the field teams. Each sample logbook will contain information such as:

- Physical measurements (if applicable)
- All QC samples
- Sample date, time, and location
- Shipping information (e.g., shipping dates, cooler ID number, destination, COC number, name of shipper).

7.1.3.2 Field Team Leader's Daily Logbook. An operational logbook maintained by the FTL will contain a daily summary of:

- All the project field activities
- Problems encountered
- Visitor log
- List of site contacts.

This logbook will be signed and dated at the end of each day's sampling activities.

7.1.3.3 Field Instrument Calibration/Standardization Logbook. A logbook containing records of calibration data will be maintained for each piece of equipment requiring periodic calibration or standardization. This logbook will contain sheets to record the date, time, method of calibration, and instrument ID number.

7.2 Sample Handling

Analytical samples for laboratory analyses will be collected in pre-cleaned containers and packaged according to American Society for Testing and Materials or EPA-recommended procedures. The QA samples will be included to satisfy the QA requirements for the field operation, as outlined in the QAPjP (DOE-ID 2000a). Only qualified (Sampling and Analysis Management-approved) analytical and testing laboratories will analyze these samples.

7.2.1 Sample Preservation

Preservation of water samples will be performed immediately upon sample collection. If required for preservation, acid may be added to the bottles prior to sampling. For samples requiring controlled temperatures of 4°C (39°F) for preservation, the temperature will be checked periodically prior to shipment to certify adequate preservation. Ice chests (coolers) containing frozen reusable ice will be used to chill the samples in the field after sample collection, if required.

7.2.2 Chain-of-Custody Procedures

The COC procedures outlined in MCP-3480, "Environmental Instructions for Facilities, Processes, Materials, and Equipment," and the QAPjP (DOE-ID 2000a) will be followed. Sample bottles will be stored in a secured area accessible only to the field team members.

7.2.3 Transportation of Samples

Samples will be shipped in accordance with the regulations issued by the Department of Transportation (49 CFR Parts 171 through 178) and EPA sample handling, packaging, and shipping methods (40 CFR 262 Subpart C and 40 CFR 263). All samples will be packaged in accordance with the requirements set forth in MCP-3480, "Environmental Instructions for Facilities, Processes, Materials, and Equipment."

7.2.3.1 Custody Seals. Custody seals will be placed on all shipping containers in such a way as to ensure that tampering or unauthorized opening does not compromise sample integrity. Clear, plastic tape will be placed over the seals to ensure that the seals are not damaged during shipment.

7.2.3.2 On-Site and Off-Site Shipping. An on-Site shipment is any transfer of material within the perimeter of the INEEL. Site-specific requirements for transporting samples within Site boundaries and those required by the shipping/receiving department will be followed. Shipment within the INEEL boundaries will conform to Department of Transportation requirements, as stated in 49 CFR. All shipments will be coordinated with WGS, as necessary, and conform to the applicable packaging and transportation MCPs. RadCon personnel shall screen all samples to be removed from the task site for radiological contaminants prior to shipment.

7.3 Document Revision Requests

Revisions to this document will follow the requirements set forth in MCP-135, "Creating, Modifying, and Canceling Procedures and Other DMCS-Controlled Documents." Any significant revisions to this document will require the concurrence of DOE-ID, IDEQ, and EPA.

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